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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

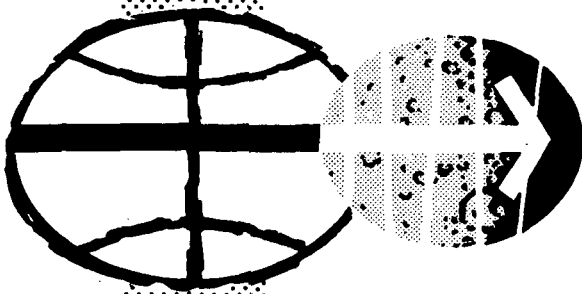
ENVIRONMENTAL IMPACT STATEMENT

For

MANNED SPACECRAFT CENTER

And

WHITE SANDS TEST FACILITY



MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

February 18, 1971

Final

ENVIRONMENTAL IMPACT STATEMENT

For

MANNED SPACECRAFT CENTER

(INSTITUTIONAL STATEMENT)

(Second Printing)

(July, 1971)

**ENVIRONMENTAL IMPACT STATEMENT
FOR THE MANNED SPACECRAFT CENTER**

INSTITUTIONAL STATEMENT

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FOREWORD

This Environmental Impact Statement of the Manned Spacecraft Center (MSC) and satellite facilities at Ellington Air Force Base (EAFB) is prepared in accordance with the National Environmental Policy Act of 1969, Executive Order 11514 dated March 5, 1970, and the Interim Guidelines of the Council on Environmental Quality dated April 30, 1970.

This statement is an expression of the environmental background in which this NASA installation was established, as well as environmental considerations used in the planning and operation of the facilities. The statement considers the environmental impact of current and planned activities of the Manned Spacecraft Center, and the interrelation with the immediate and surrounding environment from both the short and long term aspects.

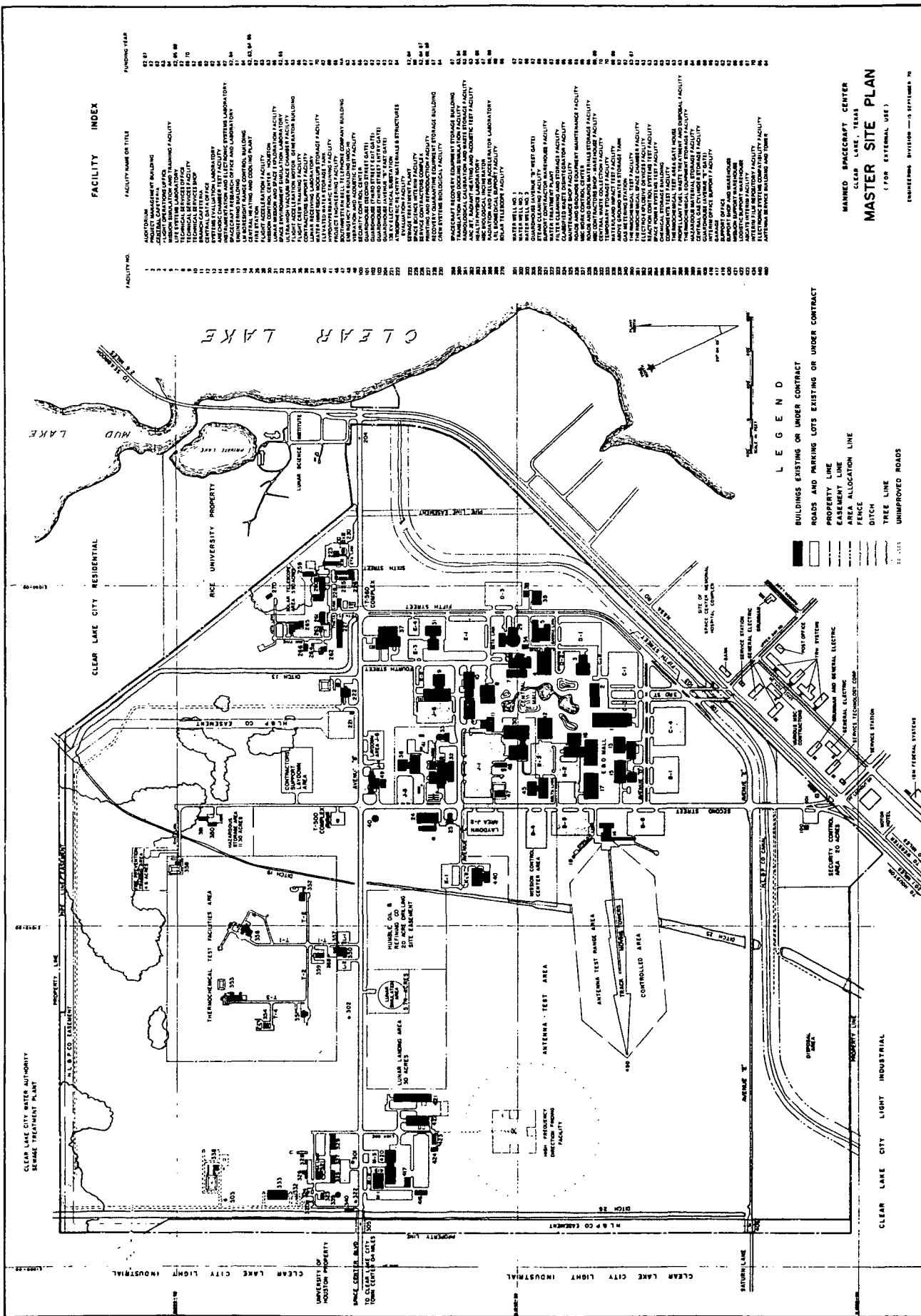
SUMMARY AND CONCLUSIONS

The National Aeronautics and Space Administration has, through the Manned Spacecraft Center, brought to the Houston - Gulf Coast area a new and challenging environment in the industry-aerospace field. This new environment has not only attracted people and increased payrolls, but has also created a broader base for the local economy. The activity of the Center has been a catalyst to private enterprise and has led to sizeable residential and commercial developments.

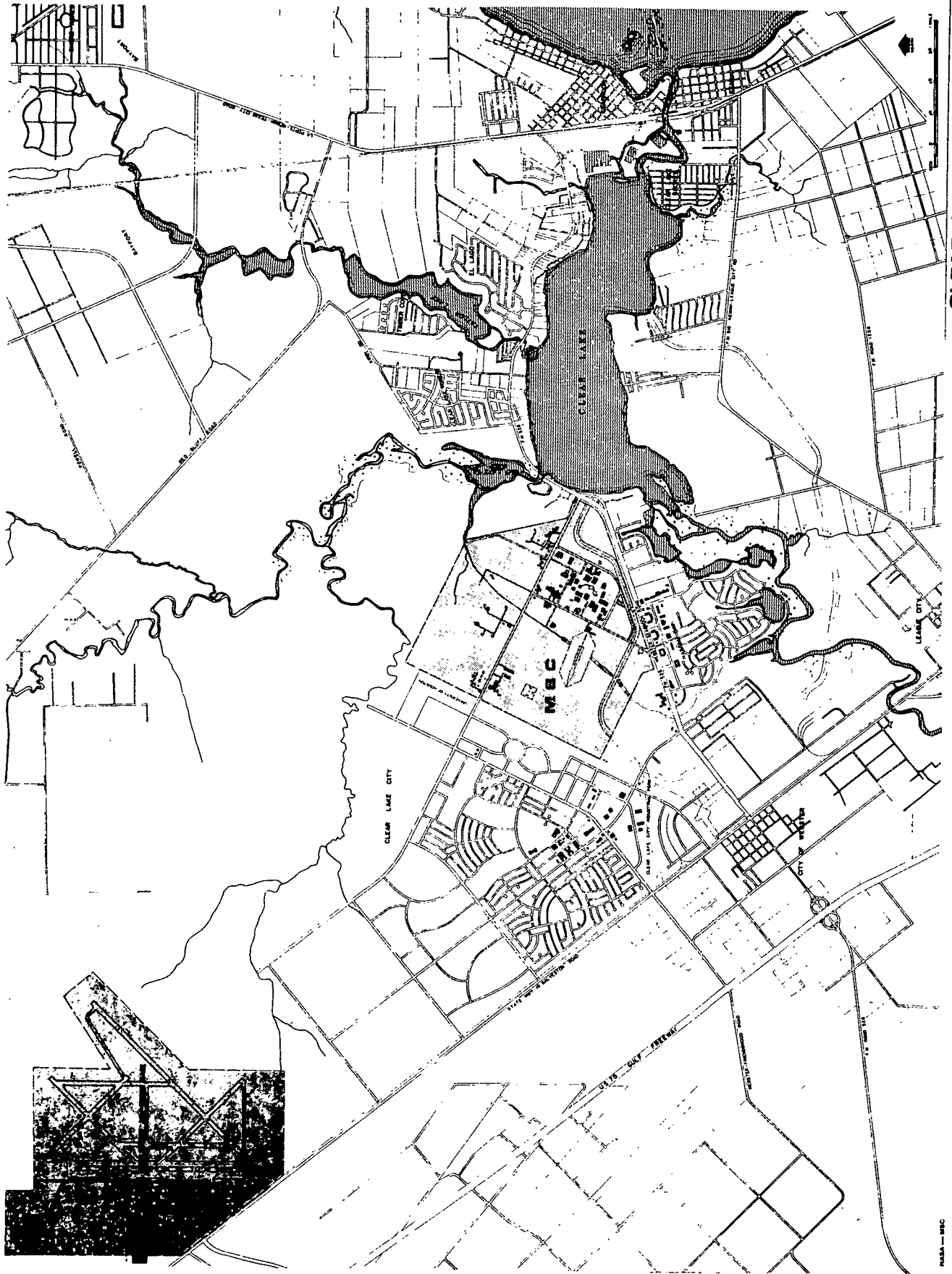
The Center is constructed on a 1620-acre site adjacent to Clear Lake, which was virtually undeveloped prior to 1960. Protection of the environment has been a significant planning consideration at MSC; and coordination has been maintained with local, state, and Federal agencies in monitoring and maintaining environmental concepts. Waste management, water pollution control, and prevention of air pollution are major considerations at MSC in the design and operation of its facilities.

Neither onsite or offsite water supplies have been, or are expected to be, adversely affected by MSC. Adequate treatment of domestic and industrial wastewater has been maintained. A feasibility study is now being conducted to establish a plan for a coordinated, Center - wide plan for advanced treatment of domestic and industrial wastewater.

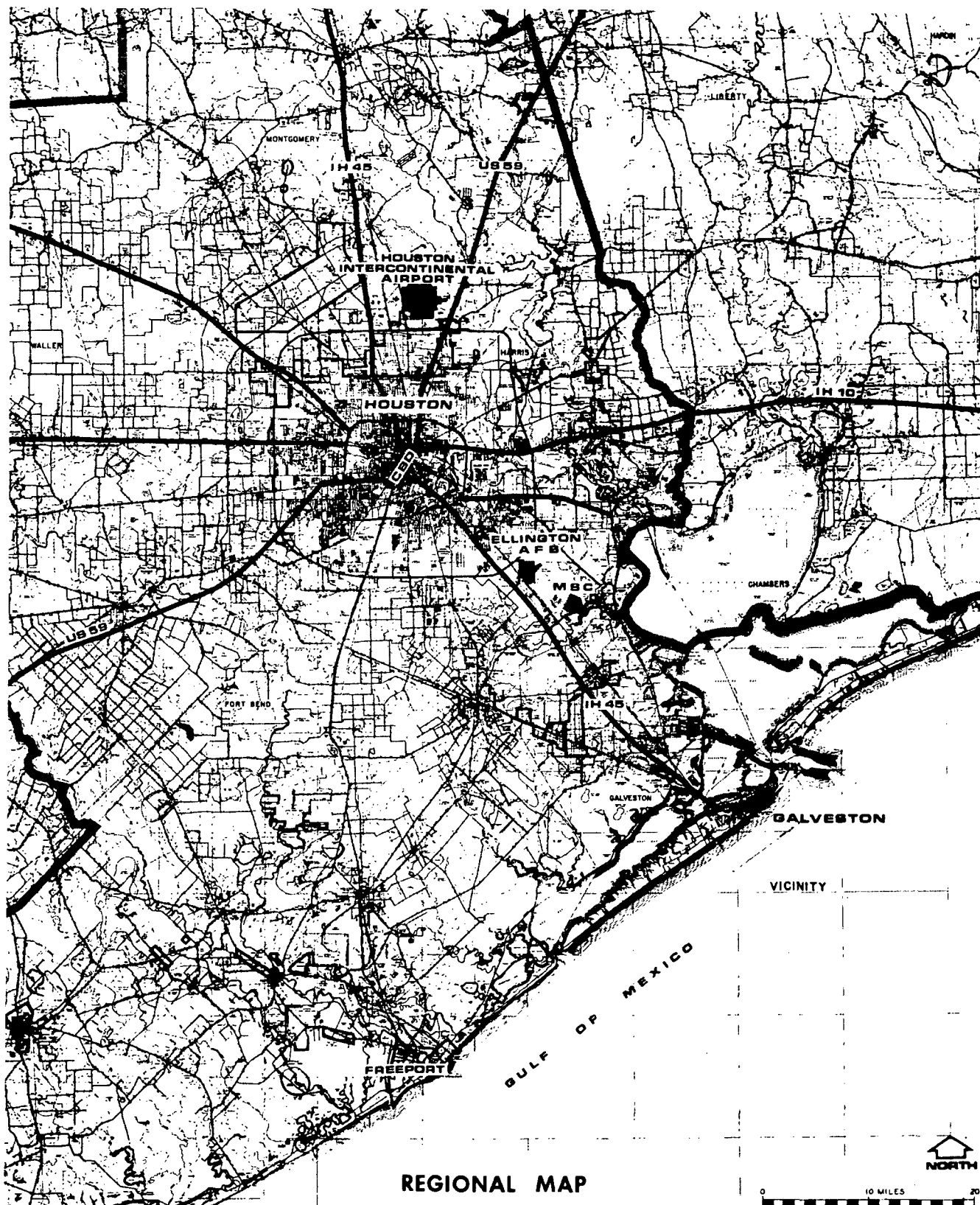
Utilizing continued strict controls over water and air pollution sources, there is no reason to expect that institutional activities of the Manned Spacecraft Center will have a detrimental environmental impact in the future.



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MESA - MSC



HISTORICAL DATA AND DESCRIPTION OF MISSION

The history of the Manned Spacecraft Center began in May, 1961. At that time, John F. Kennedy, the thirty-sixth President of the United States, in accordance with his strategic decision to accelerate the country's space program, approved the formation of a new installation for the National Aeronautics and Space Administration and its manned space flight efforts.

By August, 1961, a NASA site survey team had searched the country and investigated approximately twenty-six possible locations for the installation. The team appraised the sites on ten points, briefly stated as follows: availability of educational institutions and other facilities for advanced scientific study; electric power and other utilities; water supply; climate; housing; acreage; proximity to varied industrial enterprises; water transportation; air transportation; and local cultural and recreational resources.

On September 19, 1961, NASA Administrator, James E. Webb, officially announced that the new Manned Spacecraft Center (MSC) would be established on a 1020-acre tract near Houston, Texas. (The land, original Humble Oil and Refining Company property that had been donated to Rice University, was transferred to the Government by the University.) The site was soon expanded to 1620 acres with the purchase of an adjacent 600 acre tract. Webb stated that selection of the Houston site had been influenced by recent decisions to expand the launch complex at the Atlantic Missile Range and to establish a fabrication facility for large booster and vehicle stages at the Michoud Plant, near New Orleans, Louisiana. The Manned Spacecraft Center, the Michoud Operations, and the Atlantic Missile Range would become a vast integrated enterprise coordinating the development, manufacture, and operation of the manned space flight program.

The Manned Spacecraft Center has the prime responsibility of planning and directing the United States manned space flight program which includes the following functional areas: research, development, tests and evaluation, project management, flight operations, flight crew activities, space sciences and experiments, and medical research and operation.

I. ENVIRONMENTAL SETTING FOR MSC AND EAFB

A. LOCATION AND TOPOGRAPHY

The Manned Spacecraft Center, Houston, Texas (Clear Lake Site) is located on the north side of NASA Road 1 (a segment of Texas Farm-to-Market Road 528), two miles east of the town of Webster, Texas. The U.S.C. & G. survey station Apollo, located within the boundaries of the site has a position of North Latitude $29^{\circ} 33' 25''$ and West Longitude $95^{\circ} 05' 12''$. The site is also 25 miles southeast of downtown Houston, Texas, 25 miles northwest of the city of Galveston, and 20 miles southwest of Baytown, Texas. An eastern portion of the site lies south, across NASA Road 1 on the shores of Clear Lake, an inlet of Galveston Bay on the Gulf of Mexico.

Additional Manned Spacecraft Center facilities are located at Ellington Air Force Base (EAFB), approximately seven miles to the northwest of the Clear Lake site.

The topography of the MSC and EAFB sites is typical of the coastal plains along the Gulf of Mexico. The land is relatively flat and open, with oak and pine trees usually found growing along the water courses. The MSC site varies in elevation from 23 feet Mean Sea Level to 13 feet Mean Sea Level, sloping toward Clear Lake, in a general easterly direction.

B. GEOLOGY AND HYDROLOGY

The near surface at the MSC site consists primarily of high plasticity clays. All near surface soils throughout the site, extending to depths of 10 to 15 feet, indicate a low swelling potential under present conditions due to the relatively high water content. These soils are all part of the Beaumont Clay, a formation of the Pleistocene Age. Soil strength increases with depth down to about 15 to 20 feet where bearing loads of up to 3.5 tons per square foot are easily carried using underreamed footings. Much higher loads can be supported with short piling foundations with no deleterious deformation or settlement, although usually piling is not needed. There is no bedrock within several thousand feet of the surface.

Except for irrigated rice farms in the upper part of the Clear Creek basin, the entire water supply of the drainage area is presently derived from deep wells. Those in the MSC area draw from the Alta Loma sands, at depths from 470 to 690 feet below ground surface. Below the Alta Loma sands lie the Lissie sands, which furnish tremendous quantities of excellent ground water for Houston and other cities to the north, but which are apt to be highly mineralized at the depths at which they are encountered in the Clear Lake area.

The quality of water from the Alta Loma sands is excellent, and, if properly constructed, the wells are not subject to contamination or pollution from surface drainage or from underlying sands. The water meets all potability standards, and requires chlorination only to preclude bacterial contamination during conveyance. It is equally acceptable for industrial purposes, requiring no special treatment for most uses.

The quantity of water which can be taken from the Alta Loma sands is limited not so much by the drawdown, or rate of replenishment of the sands, as by the effect of withdrawals on the resulting subsidence of the ground surface. The Baytown-La Porte area now draws some 30 million gallons daily from the Alta Loma sands, and Galveston and Texas City also have well fields in this aquifer.

The city of Houston has well-advanced plans to develop a very large supply of surface water for the Houston-Galveston area.

C. CLIMATOLOGY AND METEOROLOGY

The Manned Spacecraft Center site is situated in an area that has a predominantly maritime climate with relatively high humidities. The daily range in temperatures is moderate compared to a continental type of climate. During the colder part of the year, numerous outbreaks of polar and arctic airmasses reach the Gulf Coast, causing sharp drops in temperature. The warming effects of the coastal air, together with the long trajectories of the airmasses, modify all but the most severe of these outbreaks. Rainfall, evenly distributed over the year, averages 45 inches annually. The growing season is over 300 days per year.

An important feature of the air pollution climatology of Houston and the entire Gulf coast area is the relatively favorable conditions which exist much of the time. The average cleansing power of the atmosphere is much better in this area than in some other locations. One major reason for this, which is immediately evident, is the very flat and level terrain, with no mountains or other natural barriers.

The next important factor is the absence of long continued inversions which characterize the well-publicized "Los Angeles smog" situation. An inversion results when air temperature increases with increasing altitude, which is the reverse of the normal situation. The importance of an inversion condition is that no vertical mixing can occur across an inversion, and thus any pollutants in the atmosphere are trapped and retained below the inversion layer. Inversions do occur quite frequently in the Houston area at night, and are caused by radiation cooling of the earth's surface, which in turn causes a decrease in the temperature of the air adjacent to the surface. After sunrise, however, the surface of the earth is warmed, which warms the adjacent air and quickly dissipates the inversion. Long continued inversions of several days' duration are extremely rare in the Gulf Coast area.

D. SEISMOLOGY AND SUBSIDENCE

No seismic damage has ever been recorded in the history of this area. Seismologists agree that the Houston area cannot have large earthquakes. Energy from basement quakes will be absorbed before affecting surface structures, and shallow quakes are of non-damaging energy levels.

Subsidence of the ground surface, along with some faulting, has been experienced in Harris and Galveston Counties. The deeper depressions of subsidence, up to four or five feet, are centered around Pasadena, Baytown, and Texas City. This regional land subsidence is largely due to lowering of water levels (piezometric ground water pressure levels) by ground water withdrawals. The present rate of subsidence is roughly estimated at about 0.17 feet per year on an over-all average.

E. BIOENVIRONMENT

1. Plant

The type of vegetation found in and around Clear Lake is typical of that found along the middle Gulf Coast. This is a semitropical area with a reasonably high rainfall, as noted previously. The high average humidity also contributes to a lush, dense growth of many types of vegetation.

The vegetation near the coast has been altered from its original native forms. The vegetation in the Clear Lake area has also been altered by the activities of man even though this was still predominately a rural area prior to the selection of the Manned Spacecraft Center site. The native vegetation consisted primarily of native hardwoods, such as post oak, elm, pecan, and hackberry. Now such trees as the chinese tallow and other ornamental trees and shrubs have also been introduced. Native grasses formerly consisted of little blue-stem, indian grass, switch grass, and silver blue-stem. These are now mixed with Bermuda, Saint Augustine grass, and KR blue-stem. Overgrazing and denuding of vegetation during construction has also encouraged the growth of the more weedy types of plants such as ragweeds, Rosin weeds, goldenrod, and marsh elders. Not all of these plants may be observed at any one time, since some of them are seasonal. Not all of these are native; some have been introduced but have adapted well and in some cases are growing wild along with the native types.

2. Animal

The Manned Spacecraft Center is populated with typical species of Texas Upper Gulf Coast wildlife. The largest wild mammal is the white-tailed deer with a herd of approximately 30 animals. Raccoons, opossums, armadillos, cottontailed rabbits, nutria and fox squirrel are native habitants of the Center.

Smaller mammals such as rats, mice, moles, gophers and shrews are also abundant. Birds include mockingbirds, English sparrows, crows, owls, hawks, seagulls, mallard ducks, geese, and white and blue herons.

The marine wildlife of the Manned Spacecraft Center and surrounding tidal estuaries consists of many species of salt and freshwater fish and invertebrates. Typical species are golden croaker (*Micropogon undulatus*), sand squeteague (*Gynoscion arenarius*), brown shrimp (*Penaeus aztecus*), and blue crab (*Callinectes sapidus*). The tidal estuaries, such as Clear Lake, act as nursery grounds for these species of marine life.

F. SURROUNDING LAND USE

The Manned Spacecraft Center is located within a community generally referred to as the Clear Lake area. This area encompasses 80,000 acres or 125 square miles located in both Harris and Galveston Counties. It is usually defined by the boundaries of the Clear Creek Consolidated Independent School District.

Included in the area are the incorporated communities of Clear Lake Shores, Kemah, League City, Seabrook and Webster. It also includes the commercial and residential developments of Clear Lake City and Nassau Bay, as well as other subdivisions and commercial centers.

G. POPULATION

In the first 6 years after NASA announced the development of the Manned Spacecraft Center, the area experienced extensive expansion. The population of the Clear Lake area increased from some 7,500 to 35,000 at the beginning of 1966. The population was estimated at 75,000 in 1970.

H. ACCESS AND TRANSPORTATION

Primary highway access to the site is by the Gulf Freeway (U.S. Highway 75) and Farm-to-Market Road 528, a portion of which is designated NASA Road 1. Two secondary highways, State 3 and State 146, also provide access from the north and the south by way of NASA Road 1. State Highway 146 is planned as a four-lane limited access freeway, which will make it a primary access route in the future.

Six major rail systems operate 14 lines of mainline track radiating from the city of Houston, and two switching lines serve the industrial areas plus the port. Two railroads serve the general area in which Manned Spacecraft Center is located. The Southern Pacific Railroad passes through Seabrook on the east, and the jointly-operated Missouri Pacific and Missouri-Kansas-Texas track passes through the town of Webster on the west. Most rail shipments for MSC are made to the team-track of the MP-MKT at Webster, which is the nearest available siding.

The present Houston Intercontinental Airport provides commercial air line service to all U.S. cities, Latin America and Europe. Eleven major airlines fly regular passenger and cargo schedules in and out of Houston.

A small portion of the site lies across NASA Road 1 on the shores of Clear Lake. This provides access by water to Galveston Bay, the Intracoastal Canal, and the Gulf of Mexico. Galveston, Houston, and Texas City are all excellent deep water ports in the MSC area. In addition, a port facility called Bayport, approximately twelve miles northeast of MSC, has been planned by Friendswood Development Company. This facility will provide approximately 20 dry-cargo berths and 20 barge berths. A barge channel and a barge dock have already been constructed.

I. WATER SUPPLY AND WATER POLLUTION FACTORS

1. Water Supply

All potable, industrial, and fire-protection water at MSC is supplied from three wells located within the boundaries of the site. These wells penetrate a 90-foot aquifer within the Alta Loma sands at depths from approximately 530 feet to 620 feet. Each well is equipped with an electric motor driven pump and each is presently producing at the rate of 600 to 700 gallons per minute. Two wells are also equipped with an auxiliary gas-engine drive.

The total water system consists of the three wells; pumps; a 1,000,000-gallon ground-storage tank; a 250,000-gallon elevated storage tank; a 100,000-gallon elevated storage tank serving only the Thermochemical Test Facilities Area; the distribution system; and chlorination equipment.

The analysis of water from the wells satisfies the requirements of regulatory agencies for a public water supply. The water is classified as extremely soft. Only prechlorination is provided as treatment to insure the safety of the potable water against post-contamination. Water supply at EAFB is also obtained from deep wells.

2. Water Pollution

Water pollution of industrial origin is mainly concentrated along the ship channel, where most of the larger industries are located. A serious degree of pollution exists in some areas. With the active pollution control program being developed by the State Water Quality Board, this situation can be expected to improve in the future. MSC does not discharge wastewater to the ship channel.

The Houston Chamber of Commerce and the State Board are presently engaged in a large scale water pollution study of the Houston ship channel.

Water pollution from municipal sewage treatment plant effluents exists in many areas, including Clear Lake and the surrounding secondary bodies of water. The degree of pollution in Clear Lake is sufficient to warrant some concern at this time. The Texas Water Quality Board has issued an order to waste dischargers in the Clear Lake watershed to provide by August 1972 advanced treatment for domestic and industrial wastewater; divert the waste from discharge to Clear Lake; totally contain and recycle all wastewater; or join a regional advanced treatment system. The Manned Spacecraft Center and Ellington Air Force Base are studying the feasibility of providing advanced treatment for wastewaters generated at their facilities. Wastewater discharge to Clear Lake by MSC has complied with standards established for this area.

J. AMBIENT AIR QUALITY AND AIR POLLUTION FACTORS

The air pollution problems which presently exist are, for the most part, localized problems down wind from specific sources of pollution. The community-wide problem of soot and coal smoke found in many eastern cities is absent, since natural gas is the most commonly used fuel. Likewise, the "oxidizing smog" type of air pollution found on the West Coast has not

occured to any alarming extent, because of the natural ventilation which removes auto exhaust and other contaminants from the air over the city more rapidly than is the case in Los Angeles and other large western cities. While the latter type of problem may become more significant in Houston as the city continues to grow, preventive measures can likely be taken to prevent serious occurrences of this nature.

Some air pollution damage to vegetation has occurred, primarily in the ship channel area. Economic loss has not been an important factor, but visual evidence of damage provides a useful indication of the relative intensity of air pollution in different portions of the community. The Houston Chamber of Commerce is presently sponsoring an air pollution study by a private consulting firm, the results of which should be available soon.

II. FACILITIES AT MSC AND EAFB WITH POTENTIAL ENVIRONMENTAL IMPACT

A. ARCHITECTURAL AND PLANNING CONCEPTS AT MSC

The character of a facility at the Manned Spacecraft Center (Clear Lake Site) is determined by its generalized functional utilization. Institutional-Support facilities are those structures such as office buildings, utility systems, roads and walks, warehouses, etc. that are basic necessities to the overall operation of any installation of this type. Program-Oriented, Special-Purpose facilities, are those structures such as research laboratories, simulation and training facilities, mission control centers, etc. that are required and designed for specific tasks associated with the missions and programs of the Center. In addition to these designations, a facility is classified according to type of construction. Permanent facilities are those that have the quality and type of material and equipment, and the details and methods of construction appropriate for a structure intended for a period of 25 years. The permanent buildings of MSC are generally steel-framed structures with exteriors of precast concrete wall panels, window walls of aluminum and solar glass, masonry, special insulated metal siding or various combinations thereof. Semipermanent construction embodies the use of materials and construction methods appropriate for a structure intended for use for a period of 15 years. The semipermanent buildings at the Center are usually pre-engineered metal structures with more economical architectural detailing than is found in the permanent facilities. Trailers and portable buildings are typical of the few temporary facilities that are in evidence at the site. Construction of these structures embodies the use of materials and methods appropriate for a building intended for use for a maximum period of 5 years.

The planning concepts employed in building design at the Center also allow for other distinctions to be made. Most high-bay laboratory spaces are windowless and enclosed with precast concrete wall panels, while most elements predominantly utilized for office space are enclosed with window walls of aluminum and solar glass. An integrated office-laboratory element is usually a square or rectangular, multi-story building with office space around the perimeter and laboratory space in the core. A typical permanent facility is characterized by a high-bay laboratory wing connected to a single or multi-story, integrated, office-laboratory wing. In some instances, these facilities are uniquely configured to the special purpose activities or equipment contained within. Those facilities specifically designed for office space are usually high-rise buildings.

In addition to satisfying the functional requirements of NASA, the Center was designed to organize and orient the buildings and land use elements in a fashion to facilitate logical future expansion and to result in a spread, campus-like atmosphere. Special attention was paid to qualities reflecting regional influences such as overhangs to protect the glass window areas and raised podiums to contrast with the flatness of surrounding areas.

B. THERMOCHEMICAL TEST AREA

The Thermochemical Test Area (TTA) provides for the development, evaluation, and qualification testing of small spacecraft propulsion engines, pyrotechnic, and electrical power systems and subsystems.

In addition to the test facilities, there is a process waste treatment plant for contaminated waste (bldg. 358), a gatehouse (bldg. 357), and an area warehouse and toolcrib (bldg. 359). The facilities are contained within a controlled access area in the northwest area of MSC. All utilities such as gas, electricity, water, process waste, and sanitary sewers are underground.

Because of the restrictive nature of the test operation, the Thermochemical Test Area and facilities are located to assure maximum safety for both on and off site personnel and a minimum of interference to other MSC facilities. Controlled access is maintained by perimeter fencing. A gatehouse is located at the entrance to the test complex. Facilities using hypergolic propellants are located at the north side of the test area. This location assures maximum safety buffer zones and takes advantage of prevailing winds from the southeast.

To maintain constant safety surveillance each facility uses fire and toxic gas detection systems. For immediate notification of a hazardous condition, the warning system at each facility is connected to an alarm network with the base fire department. An intrafacility access warning system is at the gatehouse. The system notifies personnel of the operational status of each facility. Individual facility status lights and public address systems complete the alarm network.

The propellant waste disposal system includes special deluge and disposal systems for removal of contaminated spills and vapors. All deluge flow is routed to a process waste sewer system and to the propellant waste treatment plant (bldg. 358). The plant contains holding and dilution tanks to assure that all waste effluent is neutralized. The propellant waste disposal area is equipped with a burner to dispose of bulk nitrogen tetroxide.

C. RADIOLOGICAL FACILITIES

Building 265 is used to calibrate various types of radiation equipment such as detectors, operation support instruments and scientific experiments. This facility contains one 3-Mev Van de Graaff accelerator; a 30-inch target vacuum chamber for accepting experiments of life size and reducing pressure to a 5×10^{-7} torr for flight calibration work.

Building 263 accommodates the receiving and storage of all radioactive materials at MSC. Radioactive wastes generated at MSC are also brought to this facility and stored until disposal is made offsite by a licensed contractor. This facility also serves as a calibration range for dosimeters used in manned space flight.

D. SANITARY SEWAGE AND WASTEWATER TREATMENT FACILITIES

1. Sanitary Sewage Treatment

The nature of the Manned Spacecraft Center and the neighboring Clear Lake Communities required a complete sewage treatment plant that would contribute an effluent of the highest quality and be relatively odorless. At the same time, it also required a structure of compact, harmonious appeal with the general architectural scheme of the Center. This requirement eliminated most methods of treatment except the activated-sludge process.

The population to be served by the sanitary sewer system included an immediate occupancy of 3,200. The first treatment facility, Plant 1, was therefore, designed to accommodate the load for the first 3,200 personnel, or 160,000-gallon capacity per day. As the Center developed, Plant 2 was designed to accommodate an additional 150,000-gallon capacity.

Plant No. 1 employs the aerobic-digester process and was designed and constructed to have the following features: raw sewage holding tank, or wet well, with bar screen and comminutor; two stabilizer tanks; a mixing basin; two clarifier tanks; an aerobic digester; measuring chamber; chlorine contact basin; sludge pump; sludge drying beds; and a control building housing the flow control meter, chlorine feeder, and laboratory analysis equipment. A grit chamber and a sludge thickener tank were added to this plant's operation during construction of Plant 2.

Plant No. 2 is also an activated sludge process type; however, it varies from Plant 1 in the type of equipment used and in the anaerobic digester. This plant was designed to function in parallel with the first plant and to use some common items.

The Manned Spacecraft Center and Ellington Air Force Base each provide sewage effluent meeting current regulations of 20 parts per million (ppm) in Biochemical Oxygen Demand (BOD), 20 ppm in suspended solids (s.s.), and 1 ppm chlorine residual. Each agency is now engaged in a feasibility study to determine plant modifications required to provide treated wastewater effluent with 12 ppm BOD, 12 ppm s.s., 2 ppm chlorine residual, and 1 ppm phosphorous.

2. Propellant Fuels and Oxidizers Treatment Facilities

Disposal procedures of propellant fuels and oxidizers at the Manned Spacecraft Center have been accommodated within three categories. The prime category concerns liquid wastes collected by the industrial sewage gathering system of the Thermochemical Test Area. This waste is the result of accidental spills, leaks and/or washdown procedures in the test facilities. The fuels and oxidizers tested are normally water soluble and are reduced to a safe handling level by dilution with water.

The second category is the controlled destruction of concentrated test chemicals at the Propellant Waste Disposal Plant by chemical neutralization and dilution. The third category is chemical neutralization by burning. The burning procedures are complimented by some water dilution procedures to reduce the contamination from leaks, spills and equipment usage. All disposal procedures are directed by the Chief Operations Engineer for the Operations and Maintenance Contractor. The procedures are subject to approval by the Manned Spacecraft Center Office of Environmental Medicine and the Maintenance Contractor Safety Officer. These officers will concur on the proposed procedures for destruction before implementation. The Safety Officer has authorization to suspend any operation if safety requirements are not satisfied.

3. Photographic Wastes Handling Facilities

Spent chemicals from the photographic operations at MSC are discharged to holding tanks for periodic disposal by a licensed waste disposal contractor. Film rinse water from photographic laboratories is discharged into the storm drainage system. Although this waste management program has been satisfactory in the past, MSC is now studying the feasibility of treatment needs for photographic rinse water and other possible disposal methods for spent photo chemicals.

4. Plating Shop Wastes

The Plating Shop waste treatment systems were designed to provide continuous treatment, so that the Plating Shop Facility can be operated at maximum capacity. Each system was estimated to treat in the order of 1800 gph. Waste treatment equipment is housed in the Mechanical Room adjacent to the Anodizing Shop. All process wastes must be treated so that they can be disposed of safely in the storm drainage system, or disposed of offsite by licensed contractor. The recent adoption of more stringent effluent criteria for industrial wastes has caused MSC to include plating shop wastes within the plans for advanced treatment of wastewaters, and to suspend operations considered hazardous or the discharge of wastewater untreatable to a satisfactory level.

5. Cooling Tower and Boiler Blowdown Wastes

Cooling tower and boiler blowdown wastewaters have been discharged into the storm drainage system in the past at MSC. Because of more stringent local control of phosphate and other pollutants, MSC is now studying the need and feasibility of treatment of this industrial waste.

E. PHOTOGRAPHIC LABORATORY AND DISPENSARY

The Technical Services Office, Building 8, houses the photographic processing laboratories and equipment and the dispensary and clinic. Photo wastes are generated by the medical unit as well as by the photo facility; the photo wastes produced by the medical staff result from the processing of x-ray film.

Waste chemicals are currently disposed of by the following methods:

- a. Direct drainage to chemical collection-holding tanks for subsequent pickup by a licensed waste disposal subcontractor.
- b. Collection in plastic carboys which are carried to a collection sump which is piped to the previously mentioned collection-holding tanks.

F. PLATING SHOP

The Technical Services metal finishing facility is located in Bldg. 9 and has the capabilities to provide metal finishing of aerospace and other components which shall include all electroplating processes, but not limited to, precision plating of copper, nickel, silver, gold, rhodium, platinum, electroless plating solutions, etc.; on metallic and non-metallic and on ferrous and non-ferrous alloys; solution analysis, chromate finishing; paint stripping; buffing and polishing; glass bead honing; anodizing and dyeing of all colors; etching; chem-milling activating, passivating; and electropolishing of aluminum and alloys. The facility also has the capability for measuring, and testing of all coatings.

This facility contains all plumbing to serve each tank, including supply lines for demineralized water, steam, air, and Waste Treatment Systems. The demineralized water units are capable of supplying the required water with the system operating at maximum capacity. The units were completed with resin, face piping, conductivity control valves, and accessories as required for installation. This equipment is housed in the Mechanical Room adjacent to the Anodizing Shop.

G. ENTRY ENVIRONMENT SIMULATION FACILITIES

The MSC Entry Environment Simulation Facilities provide a wide range of capability for simulating the local heat transfer rate, pressure, and gas enthalpy encountered by manned spacecraft during atmospheric entry from Earth orbit and from lunar missions. The facilities are used for performing tests in support of the development, evaluation, and qualification of spacecraft thermal protection materials and systems. Facilities consist of the 10 megawatt atmospheric reentry materials and structures evaluation facility (ARMSEF) located in building 222 and the 1.5 megawatt arc tunnel facility located in building 262.

The ARMSEF facility at building 222 requires control of nitrous oxides emissions for localized environmental health protection.

H. LUNAR RECEIVING LABORATORY

The Lunar Receiving Laboratory provides complete facilities for performing centralized receiving functions for men and materials returned from extraterrestrial space missions. It is divided broadly into three functional areas. 1) The Sample Operations Area includes the vacuum laboratory, the magnetics laboratory, the gas analysis laboratory, the physical-chemical test area, the biological test laboratories, and the radiation counting laboratory. Except for the radiation counting laboratory, the entire sample operations area is within the confines of a unit biological barrier system. 2) The Crew Reception Area, located immediately adjacent to the southern limit of the Sample Operations Area, is within a second unit biological barrier system. 3) The Support Laboratory and Administrative Area joins the other two functional areas on their eastern boundaries, and is not biologically isolated.

This laboratory has a facility for sterilization of "contaminated" wastes generated within the confines of the biological barrier. After sterilization, the wastewater is then discharged to the MSC domestic sanitary sewer system.

I. AIRCRAFT OPERATIONS FACILITIES AT EAFB

The Manned Spacecraft Center utilizes approximately fifteen buildings at EAFB in conducting its aircraft maintenance, cleaning and repair operations; astronaut training for flying proficiency; and operation and support of the Lunar Landing Training Vehicle program. Included in the facilities for these operations are hangars, warehouses and storage facilities, shops, and offices. The institutional wastes generated by MSC operations are either treated at EAFB treatment facilities, or disposed of offsite by licensed contractor.

III. RESEARCH AND DEVELOPMENT ACTIVITIES (NON-PROGRAMMATIC)

Research and development activities relating to the manned spaceflight are conducted within the following divisions of MSC:

- A. The Crew Systems Division (CSD) is responsible for the design, manufacture, development testing, qualification, and delivery to the spacecraft of systems such as the space suits, extravehicular activity systems, crew provisions, and similar crew support equipment. In addition, the division is responsible for systems in the spacecraft such as the environmental control, water and waste, and the crew couch and restraint systems. The division implements and conducts various inflight manned experiments.
- B. The Information Systems Division (ISD) is responsible for development of instrumentation, data management systems, and ground checkout systems used on manned spacecraft. It is also responsible for the planning and engineering design of digital data systems and for specialized processing and display equipment. The division provides instrument calibration and standards for MSC laboratories. Onboard checkout equipment and the development of advanced systems for the support of manned spacecraft are accomplished by the division.
- C. The Structures and Mechanics Division is responsible for the analysis, development, and evaluation of spacecraft structures, materials, and thermal protection systems. Division responsibilities include testing and evaluating the performance of complete spacecraft, spacecraft subsystems, and subsystem modules under simulated space and launch environment conditions, and conducting flammability tests on materials, components and full scale mockups. The division is also responsible for developing and evaluating spacecraft mechanical systems.

- D. The Space Environment Test Division is responsible for the planning and execution of manned and unmanned space environment simulation thermal vacuum tests. Test articles include spacecraft, spacecraft systems, extravehicular equipment, and other components of aerospace systems. The capability of man to perform useful functions inside and outside spacecraft and on simulated lunar and planetary surfaces is evaluated. The division maintains a program to advance the state of the art for space environment simulation testing.
- E. The Guidance and Control Division is responsible for providing technological support for the guidance and control systems of current and future manned space flights.
- F. The Telemetry and Communications System Division (TCSD) is responsible for planning, analyzing, developing, and engineering spaceborne-ground telemetry, communications and tracking systems; and for planning, conducting and evaluating comprehensive test programs to verify compatibility and assess operational performance. To accomplish the assigned mission, the division operates and maintains communications, tracking, and flight data laboratory test facilities including an Antenna Range, Radar Boresight Range, Radio-Frequency Anechoic Chamber, Audio Anechoic Chamber, Laser Range, and an Electronic Systems Compatibility Facility.

The MSC laser range is totally enclosed with no windows. A cylindrical tunnel approximately 10 feet in diameter and 150 feet in length is housed within the laser wing of Building 14. Partitions are provided to separate areas of experiments which use low-powered lasers. The interior of the facility is painted matte black to reduce the possibility of specular reflection. Operating procedures require controlled access to the facility. Signs and flashing lights warn of laser use, and personnel are required to use laser-protection goggles. Periodic surveys are conducted to evaluate possible hazards from laser operation.

- G. The Thermochemical Test Area (TTA) provides for the development, evaluation, and qualification testing of small spacecraft propulsion engines, pyrotechnic, and electrical power systems and subsystems.

- H. The Computation and Analysis Division coordinates the needs and directs the application of high speed digital computation and data reduction for all divisions of the Manned Spacecraft Center (MSC). Support includes processing, reduction, computation, and analysis of data resulting from engineering, development, and simulation tests and from administrative and management requirements of MSC. A wide range of high speed computers is used to provide this support. They range from medium scale equipment (used to support management and administrative applications) to highly sophisticated equipment which provides the extensive memory and high speed calculation capability necessary to support the Center's scientific research and development and data reduction.

IV. INSTITUTIONAL ENVIRONMENTAL CONSIDERATIONS

A. LAND USE

The basic factors that control and influence the land utilization patterns at the Center are derived from facility and organizational requirements; primary functional relationships between organizations and their operations; and special physical characteristics of facility operations. The major facility groupings and/or separations currently in force to meet these requirements are as follows:

1. Those facilities housing the Center's overall Administration and Management functions, Project Management functions, Flight Operations and Flight Crew Activities are located in close proximity to one another to facilitate efficient control, coordination, and interchange of data.
2. The principal vibration source at the site (spacecraft shakers in Building 49) is remotely located from facilities surrounding the Engineering and Development Mall area, some of which contain sensitive operations and equipment having a low tolerance to vibration. Special structural foundations and features for equipment as well as the distance buffer are utilized to achieve the required isolation.

3. The Antenna Test Range is so located as to be isolated from electromagnetic interference (EMI or RFI) sources. This requirement is maintained by restricting the utilization of adjacent land areas and by providing a buffer of distance from possible future EMI sources offsite. The distance buffer also minimizes EMI from Houston Lighting and Power Company overhead electrical power lines in the area.
4. The principal noise sources (operations in Thermochemical Test Facilities, arc-jets in buildings 222 and 262, and massive audio generators in buildings 49 and 262) are remotely located from the facilities surrounding the quiet Central Mall area. Further isolation is achieved by landscaping and operational control.
5. Fire fighting and medical support facilities are sited to insure the quickest response to accidents which may occur in areas where there are sources of the greatest hazard. The Fire Station (including miscellaneous emergency vehicles) is located near the geographical center of the site and is in close proximity to the Hazardous Test Area, and buildings 32, 10, 29, 222, etc. where operations of a dangerous nature are conducted. In addition, satellite medical facilities are positioned near and often adjacent to the actual operational area where human life is in jeopardy.

In general, the Land Use Plan satisfies all of the Center's current major functional requirements and relationships and tends to protect offsite adjacent land usage from objectionable or hazardous influences from the MSC site. Only a few limiting factors can be considered at this point regarding future development of the Center. Any upgrading in integrity or capability of the Antenna Test Range might require compensation for or control of offsite EMI sources. Also, the possibility of greater vibration isolation requirements in the E & D Mall area might require additional facility isolation features or curtail the operational capability of the vibration sources. Upper noise generation limits and ultimate hazardous testing capability will probably be controlled more by offsite factors than by onsite restrictions.

B. WASTE MANAGEMENT

The Manned Spacecraft Center has maintained a waste management program designed to provide a positive protection of the environment. Domestic and industrial waste water is treated and/or disposed of by acceptable standards. Garbage and refuse is contained, removed, and disposed of offsite by licensed disposal contractors. Stabilized sewage sludge and other non-putrescible waste has been buried in a sanitary landfill onsite. Studies are being made of improvements in waste management to meet changing standards by pollution-control authorities.

C. EMISSIONS FROM HEATING FUELS

The natural gas which comprises essentially all of the heating fuels used at MSC is pollution-free in sulfur content by present and proposed standards. Air scrubbers are provided on other facilities generating small amounts of air pollutants. A study of the need for improved control of nitrogen oxides from occasional operation of the test facilities at the Entry Environment Simulation Facility (Building 222) is now being made.

D. PESTICIDES AND HERBICIDES

The location of the Manned Spacecraft Center is such that it requires a year-round pest control program if grounds and facility sanitation are to be preserved.

Pest control is accomplished by non-chemical methods whenever practical. An example is the elimination of mosquito breeding grounds by providing well cleaned drainage ditches.

The persistence of many pests, however, and the impracticality or unavailability of natural controls dictate some degree of chemical usage. When pesticides must be used, care is taken to preserve the area's fish and animal life. Application plans provide for the avoidance or protection of sensitive areas. Residual-type pesticides are avoided when at all practical.

The pest control program as a whole is submitted annually for approval by the President's Working Group on Pesticides. The Group's review, recommendations, and approval provides further assurance to the Manned Spacecraft Center that its pest control program is efficient and effective with a minimum hazard to the environment.

V. ENVIRONMENTAL MONITORING AND CONTROL

A. ENVIRONMENTAL HEALTH PROGRAM

MSC maintains an active program of environmental health. Responsibility for this program is vested in the Occupational Medicine Program Office, Preventive Medicine Division, Medical Research and Operations Directorate.

Activities are broad in scope and include monitoring of all operations that have a potential for being impactive to the health and welfare of employees or the general public. Professionals are employed in the major fields of industrial hygiene, environmental sanitation, and radiological health. These professionals conduct surveys, studies, and investigations to measure, evaluate, and recommend appropriate control of those factors or stresses which may be encountered onsite or offsite. Factors or stresses may include chemical, physical, or biological agents such as gases, vapors, fumes, mists, electromagnetic radiation (ionizing and non-ionizing), noise, and bacteria. Specific monitoring is centered around operations with potential for air or water contamination.

Close liaison and working relationships are maintained with the Engineering Division, the Safety Office, the MSC Pollution Control Committee, and the MSC Radiation Safety Committee.

B. ENGINEERING DIVISION RESPONSIBILITIES

The Engineering Division of MSC is responsible for the design and operation of wastewater treatment facilities. Also, this Division monitors the sanitary landfill and other refuse disposal programs. Similarly design of facilities for control of air pollution is included in this division's responsibilities. Close

liaison is provided between the maintenance and operations branch of the Engineering Division, the Industrial Safety Office, and the Preventive Medicine Office on environmental matters. Operations data on waste treatment and waste management programs are maintained by the Engineering Division, and reports on environmental matters are prepared and forwarded regularly to other pollution-control agencies. The Engineering Division is represented on the Center's Pollution Control Committee.

C. POLLUTION CONTROL COMMITTEE

A Pollution Control Committee for the Manned Spacecraft Center was established February 18, 1970. This Committee has the responsibility to review Center activities to assure compliance with all applicable standards and criteria for air and water pollution control.

VI. ENVIRONMENTAL IMPACT

A. IMPACT OF MSC ON THE HOUSTON-GULF COAST AREA

The National Aeronautics and Space Administration (NASA) has, through the Manned Spacecraft Center (MSC), brought to the Houston area a new and challenging environment in industry-aerospace with its sophisticated skills in electronics, physics, biometrics, and other sciences. This new environment has not only attracted people and increased payrolls, but has also created a broader base for the local economy. The Houston-Gulf Coast community, whose growth had been dependent largely upon the petrochemical industry, will be increasingly enlarged and enriched. Information on new products and processes developed in NASA programs will be released to industry from MSC and will continue to attract attention to Houston's growing research and development climate.

The activity of the Center has been a catalyst to private enterprise and has led to residential and commercial developments. More than 115 aerospace-oriented companies have established offices in the Houston area. New schools and new curricula have been required. New roads have been built, and additional roads are in the planning stage. Houston has become one of the Nation's major developmental areas for the new technologies evolving from space exploration. The Center is now fairly well stabilized as to future growth. The continuing development of the area will depend primarily on the initiative of the private investors and on their ability, for example, to attract industries and to develop the academic community in accordance with the growth and needs of the people.

The national policy decisions that led to the establishment of NASA and to the selection of the Houston area as the site of a new development and management facility have now created in this country the foundation for another major science—education—industry complex. This can be only of the greatest significance to the entire Southwest and Gulf Coast area in future years.

Institutionally, the Manned Spacecraft Center has constantly maintained a program for pollution control and preservation of the physical environment. Facilities have been constructed to control air emissions and wastewater effluent within established standards. As previously described, MSC is now engaged in a feasibility study for providing advanced treatment of its domestic and industrial wastewater.

The primary environmental consequence of development of MSC in the Clear Lake area is the accelerated land and economic development, urbanization, and the associated effect in lessening wild life ranges. Parks and preserves are being developed and planned to offset this detrimental factor. Of secondary consequence is the improvement, albeit modernization, of environmental factors including drainage, transportation, and pollution control activities.

B. POSSIBLE ADVERSE ENVIRONMENTAL EFFECTS

For the Houston area, already the site of a vast oil and petrochemical industry, the selection of the Clear Lake site for the Manned Spacecraft Center portended new dimensions in scientific and technological growth. "This is wonderful news," headlined a Houston Magazine feature story which indicated that the Space Center would start an economic boom comparable to that associated with the opening of the ship channel in 1915. Businessmen, anticipating new developments in the technical commercial areas, were especially elated over the NASA choice; and the Chamber of Commerce went as far as to proclaim it "the most significant single event" in the city's economic history. Professional men began to talk in superlatives about the coming of the Manned Spacecraft Center; educators and university scientists even predicted that it would bring to Houston some of the most brilliant minds in the Nation. "Placing such talent and equipment here," said University of Houston President Phillip Hoffman, "can only have a beneficial effect."

The Center's growth in reality has provided many beneficial effects to the economic, scientific, and educational environment of the Houston-Gulf Coast area.

The acceleration in area urbanization caused by MSC will undoubtedly bring with it some increase in congestion and the need to construct new pollution-control facilities to treat the increased flows of wastewater. These effects need not be detrimental to the environment however. Regional pollution-control planning is now being done.

Utilizing continued strict controls on pollution sources as previously described, there is no reason to expect that the Center's future activities will differ significantly from the past or cause a serious adverse impact on the environment.

C. ALTERNATIVES FOR ENVIRONMENTAL IMPACT

Continuance of the current and proposed manned space flight program leaves no practical alternatives to the functions of the Manned Spacecraft Center.

As previously explained, the environmental effects of the Manned Spacecraft Center on the Clear Lake area are more beneficial than detrimental. No significant air pollutants are generated at the MSC facilities or at the adjacent aerospace industries. Wastewater treatment facilities are being maintained or planned to comply with more stringent effluent standards.

In the event a specific research and development requirement of the Center would generate a pollutant unacceptable to the Clear Lake environment, relocation of the activity to the remote area of the satellite White Sands Test Facility is possible.

D. RELATIONSHIP OF SHORT-TERM AND LONG-TERM EFFECTS

The short term effects of MSC on the environment of the Houston-Gulf Coast area is evidenced in the increased economic development of the region. Such effects have close relationship with longer-term results, such as commitment of land use and road development.

The total effect of MSC appears to offer an enhancement and better maintenance of long-term productivity and protection of the physical environment in the Clear Lake area.

E. IRREVERSIBLE COMMITMENTS AND EFFECTS

The Manned Spacecraft Center has induced an accelerated growth in the Clear Lake area. This growth has contributed to irreversible commitments in such areas as land development, community locations, and road networks. The effects of these commitments are favorable to the enhancement and development of the total environment of the area.

VII. COORDINATION WITH LOCAL, STATE, AND FEDERAL AGENCIES

Beginning with the early planning of MSC, site planning and roads development were discussed and coordinated between representatives of local municipalities, adjacent counties, and the State Highway Department. Development of waste treatment facilities have been reviewed and approved by state and local authorities. Sewage treatment records are forwarded monthly for review by appropriate state and Federal agencies. An environmental survey of the site is conducted annually by Federal Pollution Control representatives. The Manned Spacecraft Center maintains a liaison with local, state, and Federal authorities on environmental matters, and is endeavoring to provide a satisfactory and coordinated pollution-control program.

VIII. PUBLIC INFORMATION

The Public Affairs activities are strategically located at the "front door" of the Center to facilitate liaison with the public, to control the activities of visitors to the site, and to support the Center's administration and management endeavors.

IX. SUMMARY

The Manned Spacecraft Center is constructed on a 1620-acre site adjacent to Clear Lake, which was virtually undeveloped prior to 1960. The Center brought to the Houston-Gulf Coast area a new and challenging environment in industry-aerospace, and created a broader base for the local economy. Beneficial effects have been felt in the economic, scientific, and educational environments.

Institutionally, environmental considerations are significant factors in the planning and design of facilities at MSC. Coordination has been maintained with local, state, and Federal agencies in environmental matters ranging from development of road systems to operation of wastewater treatment facilities.

Water and air pollution control are major considerations in the design and operation of facilities. The Center is continually reviewing its operations for improvements in pollution—control activities. A feasibility study is now being made for a coordinated, Center—wide advanced treatment system for domestic and industrial wastewater.

Utilizing continued strict controls over water and air pollution sources, there is no reason to expect a detrimental environmental impact from activities of the Manned Spacecraft Center.

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**ENVIRONMENTAL IMPACT STATEMENT
WHITE SANDS TEST FACILITY, NEW MEXICO
(INSTITUTIONAL STATEMENT)**

**ENVIRONMENTAL IMPACT STATEMENT
FOR THE WHITE SANDS TEST FACILITY
INSTITUTIONAL STATEMENT**

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FOREWORD

This environmental statement for the White Sands Test Facility is prepared in accordance with the National Environmental Policy Act of 1969, Executive Order 11514 on Environmental Quality dated April 30, 1970.

This statement is an expression of the consideration given to interactions of the WSTF operations on the environment. Particular emphasis is given to the manner and effects of conducting stationary ground tests of liquid fueled rocket engines, flammability and toxicity screening of spacecraft non-metallic materials, and related systems and component testing required to accomplish the development of spacecraft propulsion systems for manned space flight. The statement considers the scope of current activities at the White Sands Test Facility during 1971 as they related to possible interactions on the immediate and surrounding environment from both short and long term aspects.

SUMMARY AND CONCLUSIONS

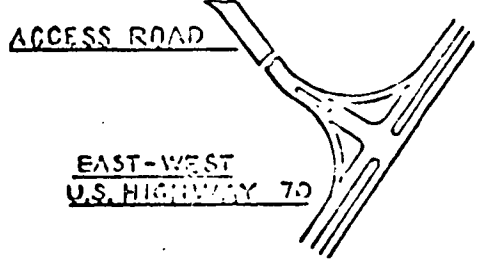
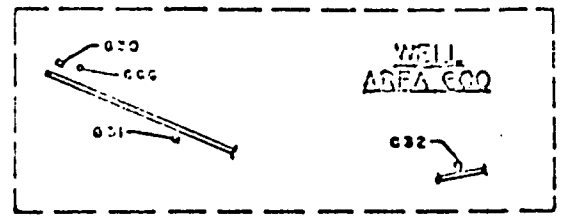
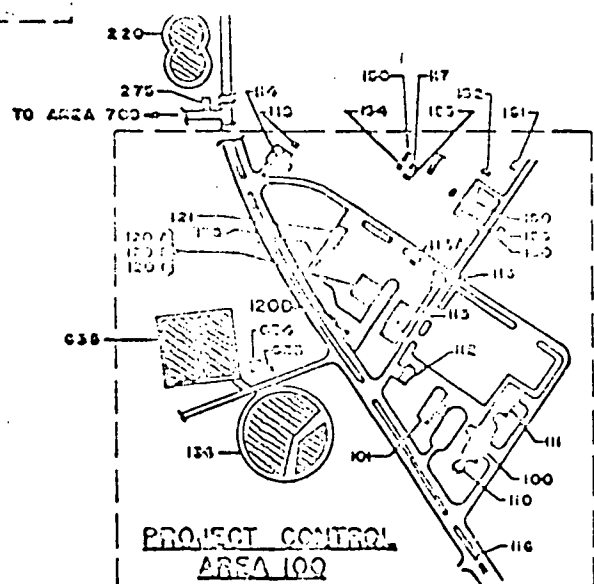
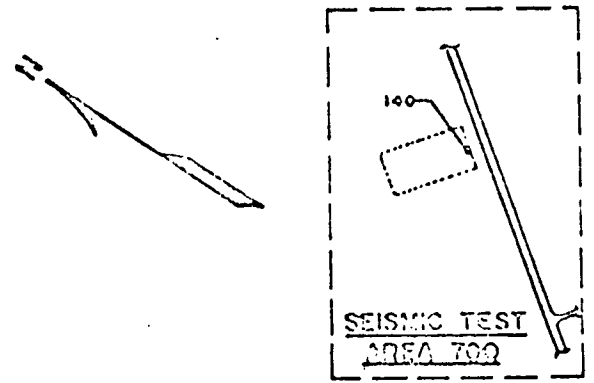
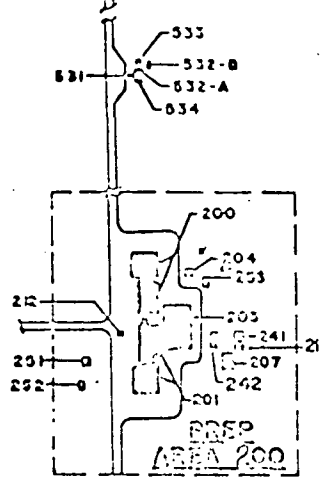
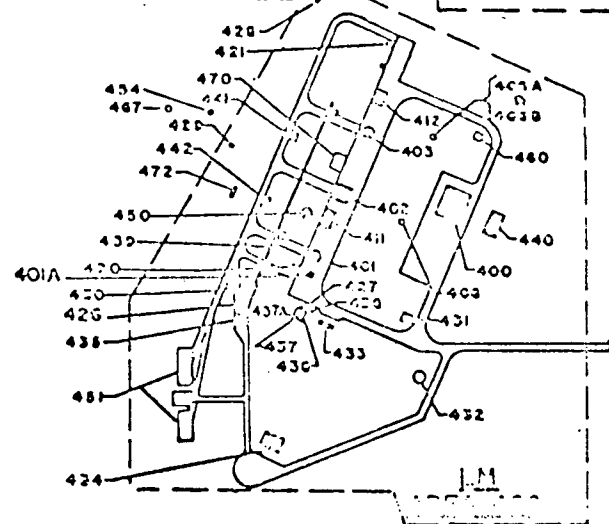
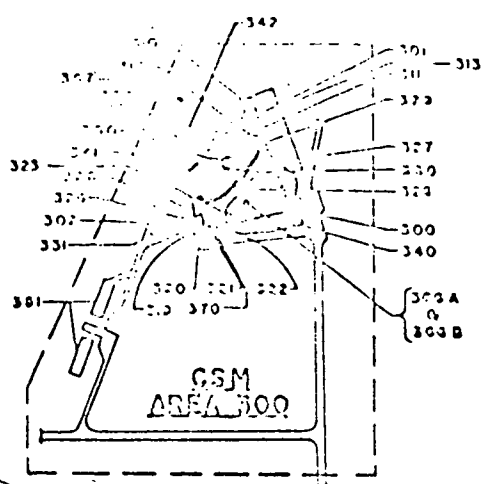
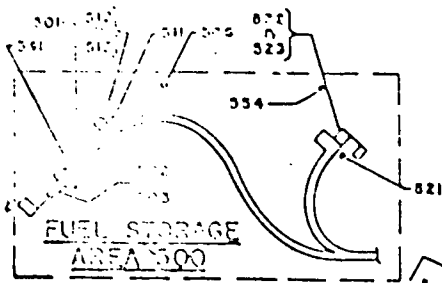
Based upon the experience of operating the White Sands Test Facility and testing Hypergolic Propellant Engines since 1964, it is considered that the impact from WSTF activities on the human environment and use of surrounding land will be negligible, during both the short and long range periods. State officials have been contacted for guidance and it has been determined that WSTF activities comply with state regulations and standards.

Toxic propellant vapors from the test areas are vented to special burner systems or water filled ponds rather than permitting them to be released directly to the atmosphere. Toxic fumes from the chemical laboratory are passed through air washers and the resultant liquid is handled by the acid drains. Waste liquids from all areas are neutralized prior to release to grade. Neither onsite or offsite water supplies have been affected as a result of the White Sands Test Facility operations and water wells within ten miles are sampled on an annual basis to determine if the water supply has been influenced.

While WSTF, as a land resource, is committed to R & D program testing for an indefinite period, the environmental effects do not preclude it from other uses. The wildlife population in the immediate area has flourished since the opening of WSTF, primarily due to the abundant surface water supply and the protective environment offered within the confines of the site proper. The Dona Ana County Vector Control Office is presently using one of the WSTF sewage lagoons for raising minnows used in its mosquito control programs.

The remote location of the site minimizes the possibility of site operations being a nuisance due to noise, sight, odors, or toxic conditions. By continuing the use of strict meteorological controls, there is no reason to expect results in the future to differ from experience in previous years.

WASTE BUILDING IDENTIFICATION



100 - JSM Project Control Bldg.
 101 - IM Project Control Bldg.
 110 - Sifting Building
 111 - Catwalk
 112 - Emergency Center
 113 - Mech. Maint. & Trans. Bldg.
 113A - East Bldg. 113 - Wash Rack
 114 - Reproduction Building
 115 - Paint Storage Bldg.
 116 - Security Guard Station (Main Gate)
 117 - Fuel & QC Storage Bldg.
 118 - Fire Department Storage Bldg.
 120A - Warehouse - Zia
 120B - Warehouse - Zia
 120C - Warehouse - STC
 120D - Paint Storage
 121 - E & B Maint. Bldg.
 130 - Sewage Lagoon (Admin. Area)
 140 - Seismic Test Building
 150 - Support Warehouse
 151 - GSA Vehicle Service Bldg.
 152 - Lumber Storage Bldg.
 153 - Chemical Storage Bldg.
 154 - Sling Storage Bldg.
 155 - Freon Storage Bldg.
 156 - Storage Laborers & Equip. & Tools
 158 - Storage (GSE) Tiki Hut
 160 - 50 Ton Scale

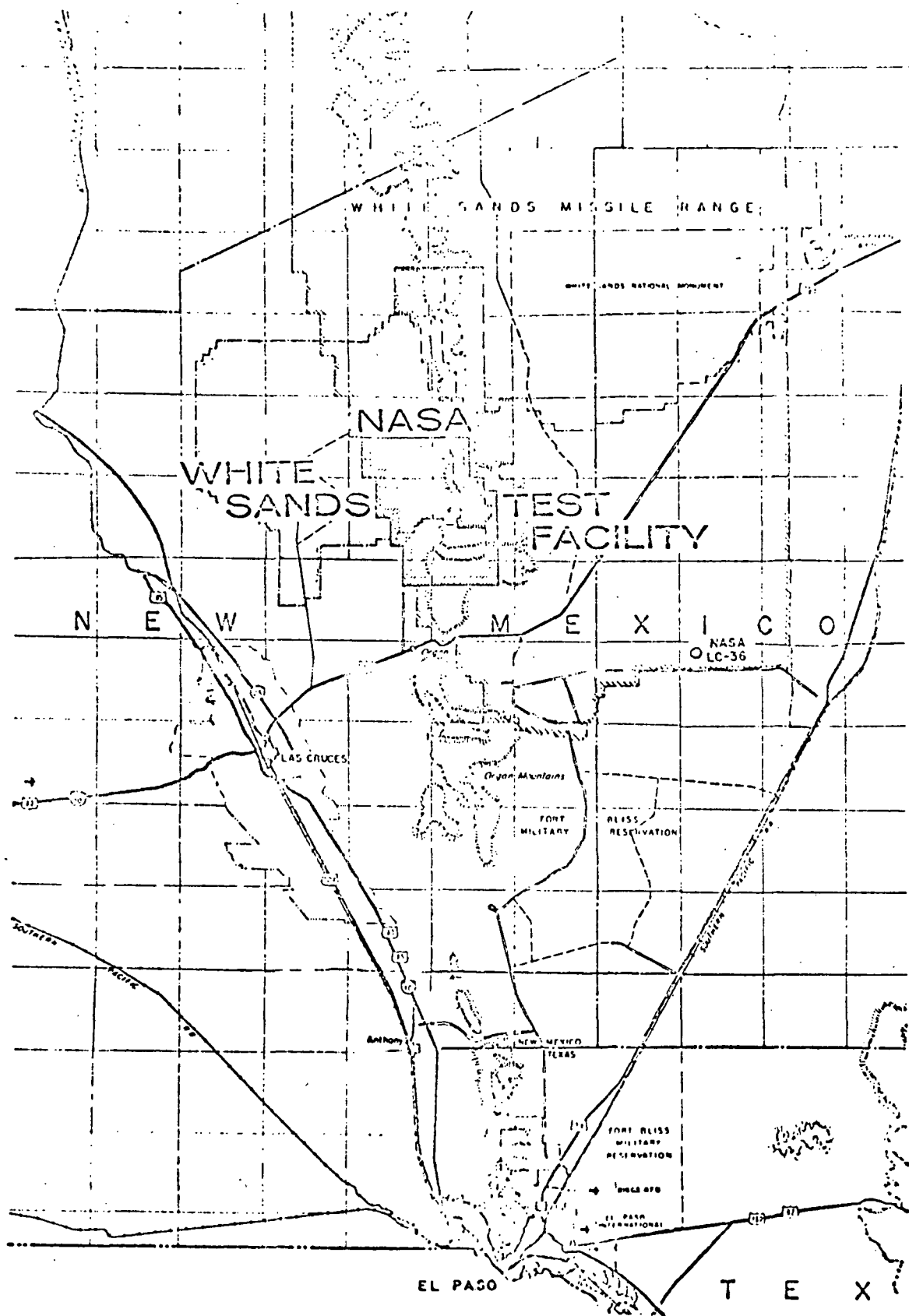
200 - CSM Preparation Bldg.
 201 - IM Preparation Bldg.
 203 - NASA Laboratory Bldg.
 204 - Freon Storage Vessel
 207 - Pressure Test Facility
 211 - Intensifier Bldg.
 212 - Security Guard Station
 220 - Sewage Lagoon (Prep)
 241 - LTV Pressure Test
 242 - LTV Pressure Test Control Center
 251 - Battery Bldg. - Test Prep Area
 252 - Welding Shack
 253 - LTV Chemical Storage
 275 - NASA Pyrotechnics Bldg.

300 - CSM Test Control Center
 301 - Test Stand 301
 302 - Test Stand 302
 310 - GSE Shelter - Test Stand 301
 311 - GSE Term. Rm. & Tunnel (TS 301)
 312 - Battery Bldg. - Test Stand 301
 313 - Valve Pit
 314 - Remote Camera Tower (TS 301)
 319 - Vacuum Pump House
 320 - GSE Shelter - Test Stand 302
 321 - GSE Term. Rm. & Tunnel (TS 302)
 322 - Battery Building (TS 302)
 323 - Valve Pit
 324 - Remote TV Tower (TS 302)
 326 - Fuel Conditioning Shelter
 327 - Oxidizer Conditioning Shelter
 328 - Remote Command Building
 329 - Closed Circuit TV Tower
 330 - Closed Circuit TV Tower
 331 - Remote Camera Tower
 340 - Diesel Generator
 341 - Fuel Dump TK, and Shelter
 342 - OX Dump Tank and Shelter
 350 - 80,000 Gallon Water Tank
 351 - Holding Ponds 1 & 2
 354 - Oxidizer Burner
 366A - Wind Trans. & Recorder
 366B - Trans. & Recorder
 367 - Wind Trans. & Recorder
 370 - LN₂ Tank

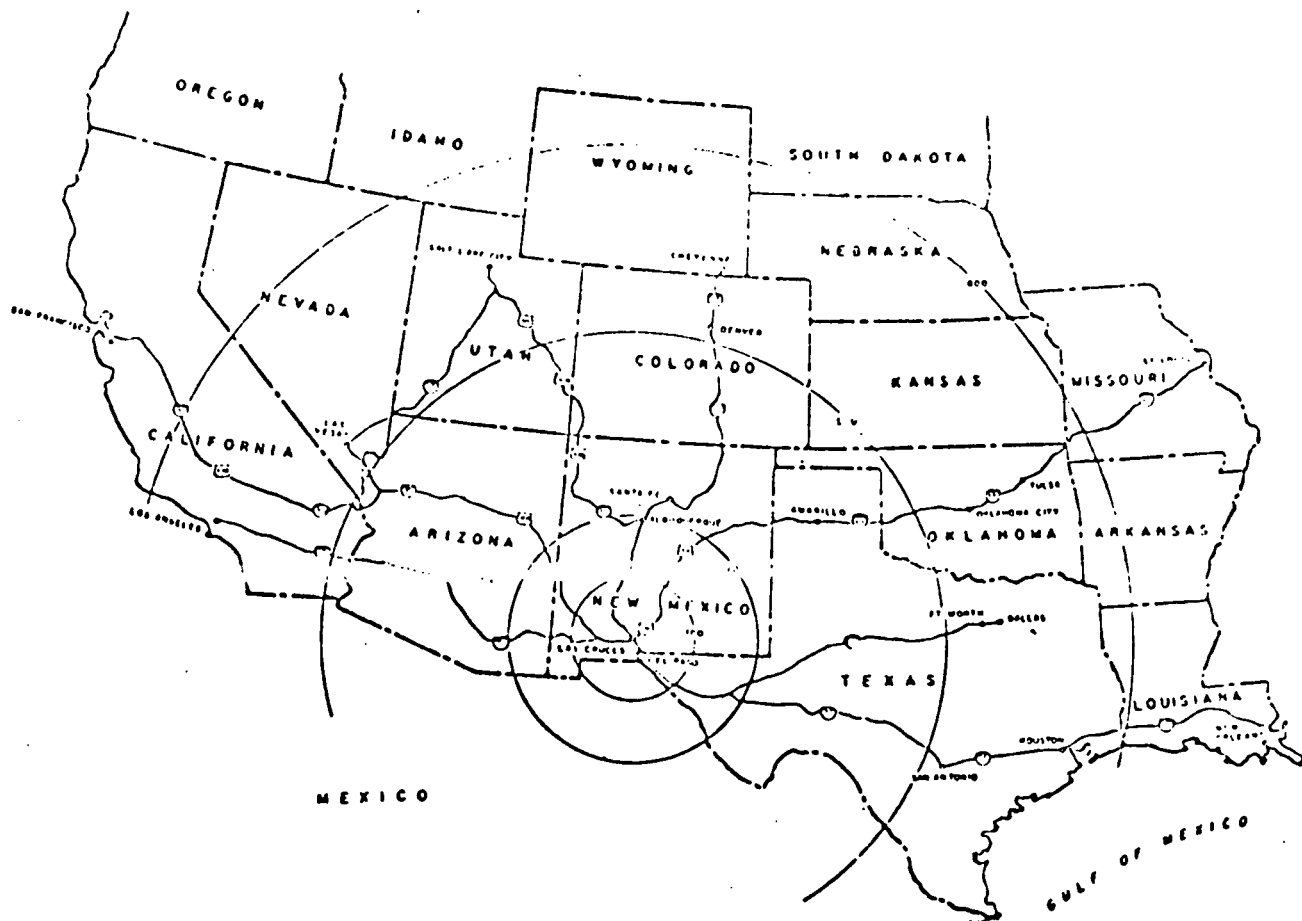
400 - IM Test Control Center
 401 - Test Stand 401
 401A - Oxid. Control Building
 402 - Test Stand 402
 403 - Test Stand 403
 411 - Stand Support Bldg. #1
 412 - Stand Support Bldg. #2
 420 - Oxidizer Ready Storage
 421 - Fuel Ready Storage
 426 - TV Tower
 427 - TV Tower
 428 - TV Tower
 429 - TV Tower
 430 - Steam Generator
 431 - Steam Generator Switch Gear Bldg.
 432 - Isopropyl Alcohol Storage Tank
 433 - Isopropyl Alcohol Run Tank
 434 - LOX Storage Tanks
 435 - LOX Run Tanks
 436 - Steam Generator Diesel
 437 - Steam Gen. Diesel Control (Bldg. #1)
 437A - Steam Gen. Diesel Control (Bldg. #2)
 438 - Steam Generator Diesel Fuel Tk.
 439 - 30" Steam Line
 440 - Diesel Generator Bldg. (EPS & UPS)
 441 - Fuel Dump Tank & Shelter (Sunshade)
 442 - Oxidizer Dump Tk. & Shelt. (Sunshade)
 450 - 80,000 Gallon Cooling Water Tank
 451 - Holding Ponds 1 & 2
 454 - Oxidizer Burner
 460 - GSE Shelter
 466A - Wind Trans. & Recorder
 466B - Wind Trans. & Recorder
 467 - Wind Trans. & Recorder
 468 - Weather Inst. Shelter
 470 - Nitrogen and Helium Storage Area
 472 - Helium Storage Tank

501 - Fuel Storage Control Bldg.
 502 - Fuel Storage Vessel
 503 - Shelter
 511 - Hydrogen Storage Control Bldg.
 512 - Hydrogen Storage Vessel
 513 - Shelter
 521 - Oxidizer Storage Control Bldg.
 522 - Oxidizer Storage Vessel
 523 - Oxidizer Storage Shelter
 531 - Control Building - Cryogenics
 532A - Liquid N₂ Storage Vessel 4,500 Gal.
 532B - Liquid N₂ Storage Vessel 13,500 Gal.
 533 - Gaseous N₂ Storage - 3 Vessels
 534 - LOX Storage Vessel
 541 - Methyl Alcohol Storage Vessel
 554 - Oxidizer Burner
 566 - Wind Trans. & Recorder

600 - Water Storage Vessel (1,000,000 Gal.)
 630 - Well "I"
 631 - Well "J"
 632 - Booster Sta. #1
 633 - Booster Pump Sta. No. 2 & Chlor. Bldg.
 634 - Water Treatment Plant
 635 - Evaporation Ponds
 666 - Wind Trans. & Recorder - Well "I"
 700 - Special Test Area Seismic



REGIONAL MAP



LOCATION MAP

HISTORICAL DATA AND DESCRIPTION OF MISSION

Although the southern New Mexico area was first explored by Europeans in the late 1500's, it was not settled by them until the early 1700's, because the available irrigable land was not as extensive as in northern New Mexico and because the area was controlled by hostile Indian tribes. The original Mesilla Crown Colony Grant (ca. 1705) confines the settlement of the Spaniards to the narrow band of the Rio Grande River. Although this area was taken over by the United States in 1846, it was not until the arrival of the railroad in Las Cruces, in 1881, that ranching became a profitable activity. By act of the Territorial Legislature the agricultural and mechanical college for the state (now New Mexico State University) was located in Las Cruces in 1883, and the community began a slow but steady growth. Nevertheless, because of climatic and economic limitations, the population density in this area remained so low that, in the early part of World War II, the U.S. Army Air Corps established the Alamogordo Bombing Range; the U.S. Army Anti-Aircraft Artillery School acquired the Dona Ana Firing Range; and the Manhattan Project selected Trinity Site (68 miles north of the present White Sands Test Facility) for the first nuclear weapons test. At the close of World War II, these holdings were consolidated into the White Sands Proving Grounds, (now White Sands Missile Range) to provide a test site for the development of rockets and guided missiles.

In 1962, the National Aeronautics and Space Administration, seeking a remote location for the hazardous testing associated with the development of the Apollo Spacecraft Propulsion Systems, selected an 88-square-mile portion of the White Sands Missile Range, 20 miles east of Las Cruces, New Mexico. The White Sands Test Facility, which was established by the NASA Manned Spacecraft Center in 1963, actively supported the Apollo Program in the qualification of spacecraft systems by satisfactorily completing integrated ground testing of the Service Module, Service Propulsion, Reaction Control, and Electrical Power Systems; flight testing of the Command and Service Module Structures, Launch Escape System and Earth Landing Systems; flammability and toxicity screening of spacecraft non-metallic materials; and related systems and component testing.

The present mission of White Sands Test Facility includes:

1. Manned and unmanned spacecraft propulsion systems development and certification testing.
2. Special testing of materials, components, and subsystems which involve hazardous environments and require other unique capabilities of White Sands Test Facility.
3. Sponsor of NASA programs conducted at the Department of Defense operated White Sands Missile Range (WSMR), involving rocket and aircraft flight testing, electromagnetic radiation, and other WSMR capabilities.

I. ENVIRONMENTAL SETTING FOR WSTF

A. LOCATION AND TOPOGRAPHY

The NASA White Sands Test Facility is located on the western edge of the White Sands Missile Range, on the western slopes of the San Andres mountains, five-and-a-half miles north of U.S. Highway 70 and 16 air miles north of Las Cruces, New Mexico.

The land area under WSTF control totals approximately 56,000 acres. Approximately 54,400 acres of this total is the site proper, the remainder being access road easements and 1280 acres for protection of the site water supply source. This land area is not owned by NASA; it is occupied by NASA as a tenant under the terms of a use agreement with the Department of Defense and a memorandum of understanding between NASA, DOD, and the Department of Agriculture, Agricultural Research Service.

The WSTF site is located on dissected alluvial fans bounded on the east by the San Andres mountains rising over 6,000 feet above sea level and on the west by a broad uniformly sloping plain extending to the Dona Ana mountains. These fans are scoured by many deeply eroded channels and arroyos. The lowest elevation in the Jornada del Muerto basin between these two mountain ranges is approximately 4,290 feet above sea level, in a dry lake which is the major terminus of stream flows from the adjacent mountain ranges.

B. GEOLOGY AND HYDROLOGY

The geology of the area is complex, but, in greatly simplified terms, probably consists of a basement complex, which is exposed in the San Andres and Dona Ana mountains, an alluvial layer called the Santa Fe group, and an upper layer termed "recent alluvium." The basement complex consists of igneous, metamorphic, volcanic and sedimentary rock such as Precambrian Granite, Gneiss, and Schist; Paleozoic dolomites and limestones; Mesozoic sedimentary rock such as Dakota sandstone and tertiary volcanic lavas and tuffs.

The middle alluvial layer, the Santa Fe group, consists of semiconsolidated and unconsolidated rock deposited from Pliocene through Pleistocene times. The layer is composed of heterogeneous alternating lenses of caliche, limestone, siltstone, sandstone, conglomerate, gravels, silts, sands and clays.

The thickness of this layer probably ranges from less than 200 feet in the basin floor to 700 feet beneath the alluvial fans along the mountain flanks. The upper-most alluvial layers, the recent alluvium, upon which the WSTF is located, consist of silt, sand, gravel, boulders, and locally cemented conglomerates and probably range from 400 to 700 feet thick in the area of the site. The area is cut with numerous arroyos that flow only during periods of rainfall.

C. CLIMATOLOGY AND METEOROLOGY

The White Sands Test Facility is located in the ecological zone described as Upper Chihuahuan Desert. Vegetation is characterized by sparse clumps of grama grasses, mesquite, and greasewood. The area has an arid continental climate characterized by low rainfall, low humidity, moderately warm summers and mild winters. The area has approximately eight inches of rainfall per year (varying from six to 11 inches at different stations, depending on local terrain); over half of the rainfall occurs in July, August and September in brief but occasionally heavy thundershowers. Prolonged rains are practically unknown. Measurable snow falls on the average of two out of three years but for a total of less than three inches in a year, with rarely any accumulation. At times hail accompanies summer thundershowers. There is no record of tornados in the area.

Summer daytime temperatures reach 90°F or higher during an average 80 days a year; the daily temperature excursion averaged 26°F. In the coolest month of the winter, daytime temperatures generally range between 50 to 60°F. Nighttime temperatures fall below freezing more than half of the time between November and February, but only once in 30 years has the temperature dropped below 0°F. The area normally experiences from 75 to 80 percent of the sunshine possible each day; complete overcast is relatively rare, averaging less than 34 days per year; weather conditions restricting general aviation flying VFR occurs less than five days per year.

Humidities are low, averaging slightly less than 50% and ranging from 60% in the early morning to less than 30% during warmer hours. Evaporation from a free-water surface, as recorded in a Class A evaporation pan, averages 90 inches per year (more than ten times the average rainfall).

Winds are usually light, averaging less than ten miles per hour throughout the year. Occasional high-velocity winds occur, principally in the spring months; since air density is 86% of sea level values, effective wind forces are less than absolute velocities would indicate.

Wind roses for the four seasons, as measured at the WSMR weather station, indicate the following:

Winter: Westerlies prevail. No significant winds, either in elapsed time or in total air-mass movement, occur in the 225° from north-northwest to south-southwest. The air-mass movement from the west is 34.2%.

Spring: Southwest winds gain in importance, but the general west tendency increases. Air-mass movement from the west is 36.6%

Summer: During the summer rainy season, two major wind portions exist: south to southeast (17% of air-mass movement) and west to northwest (16.8% of air-mass movement).

Autumn: The southwest winds weaken somewhat, while the west winds strengthen; however, the preponderance of west-wind conditions is not re-established until mid-winter.

D. SEISMOLOGY AND SUBSIDENCE

The Jornada del Muerto is a structural basin which appears to be primarily a syncline, with only minor peripheral block faulting. The San Andres mountains were formed by westward tilting of the sedimentary rock sequence due to uplift along a fault system on their eastern edge. A fault, trending north-south, is evident in the area immediately to the east of the WSTF site; however, there is no record of seismic activity along the fault and none has probably occurred since tertiary time. The WSTF is in a Uniform Building Code Seismic Zone 2.

E. BIOENVIRONMENT

The area supports large numbers of song birds, quail, and rabbits in test and office areas with deer, coyote, bob cat, badger and fox being found, in substantial numbers, in the remote areas. The quail and rabbit populations in the immediate area have increased since the site was opened and it is not uncommon to see ducks using WSTF holding ponds and sewage lagoons. One of the larger lagoons is presently being used by the Dona Ana County Vector Control Office for raising minnows used in the county mosquito control programs. In addition to the wildlife noted, livestock is raised on nearby ranches with a population of approximately five head per section.

F. SURROUNDING LAND USE

Areas adjacent to WSTF to the south and west for approximately four miles are essentially unpopulated, being utilized for grazing of livestock. The area to the north and east is the White Sands Missile Range.

G. POPULATION

The metropolitan area of Las Cruces has a population of 47,000 and Dona Ana County, 85,000 with the majority being concentrated along the Rio Grande Valley located approximately 15 miles to the west of WSTF. There are some outlying areas (scattered homes and trailers) that extend from Las Cruces to within four miles of the WSTF Administration area and five and one half miles of the test areas.

H. ACCESS AND TRANSPORTATION

Access to the WSTF is by U.S. Highway 70, a four-lane divided heavy-duty highway joining Interstate Highways 10 and 25 at Las Cruces. A government-owned two-lane access road with four-lane terminuses at Highway 70 and the WSTF provides access to the site. Visitors to WSTF normally arrive at the commercial air terminal at El Paso International Airport; overnight lodging is readily available at El Paso or Las Cruces. Logistically, the site is serviced by three railroads, off-loading at Las Cruces; commercial air shipments are received at El Paso and major air logistics support, as for shipment of large test articles, is provided by Holloman Air Force Base at Alamogordo, New Mexico. Personnel transportation to and from work is provided by private automobile with no bus service available.

I. WATER SUPPLY AND WATER POLLUTION FACTORS

The facility water supply is from two 12 inch, 460-foot deep wells located approximately four and one half miles west of the administration area. Water is pumped from the wells through a zeolite softening plant and approximately six miles of piping to a 1,000,000 gallon storage reservoir. The wells and piping are all located on government-owned property.

Fuel vapor from test operations is absorbed in water filled concrete lined ponds where it is held for neutralizing. Waste from test stands is collected in concrete lined ditches and conveyed to concrete holding ponds for neutralizing before discharging to grade. Toxic waste materials from laboratory operations are collected in holding tanks and then transported to evaporation ponds used for disposal of back wash from zeolite water softeners. These evaporation ponds are plastic lined to prevent permeation into the soil. The underground water table is approximately 400 feet below grade and the nearest stream is the Rio Grande River 15 miles away.

Close chemical checks are made of all liquid releases made to grade to insure that they have been neutralized. Samples of water from wells within ten miles of the site are analyzed on a yearly basis as a safety check to assure that the water table is not being affected.

J. AMBIENT AIR QUALITY AND AIR POLLUTION FACTORS

The ambient air quality and weather conditions are among the best in the country. The atmospheric visibility "seeing" conditions area, for the most part, ideal with visibility being in the fifty to 100 mile range (except in the El Paso region 60 miles to the south).

Air pollution from site operations has not occurred, and is not foreseen, due to the climatology of the area and the operational methods of controlling air pollutants. Toxic propellant vapors are vented to special burner systems or water filled ponds rather than permitting them to be released directly to the atmosphere. For the most part, release of propellants are controlled using pre-established times; however, minute quantities are sometimes vented to burners or ponds during activation of various tank and system relief devices.

II. FACILITIES AT WSTF

A. TEST AREAS

The architectural concepts used at WSTF are for fuel and oxidizers to be handled in closed loop piping systems with venting being either to propane burners or water baths. Areas that are subject to spills of toxic liquids are paved with concrete and sloped to concrete lined catchment ponds for dilution and neutralization. Sewage is handled by septic tanks and tile fields for minimal sewage flow.

B. LABORATORY AREA

Toxic liquid waste is handled by acid resistant drains terminated in lined underground tanks. When the tanks are filled they are pumped out and the liquid transported to the evaporation ponds used in conjunction with the water treatment plant. Fuel and oxidizer fumes from the chemical laboratory are caught in air washers and the resultant liquid being handled by the acid drains. Sewage is collected in a separate drain system from that above and transported to clay lined lagoons for disposal by aerobic bacterial digestion and evaporation of most of the effluent.

C. ADMINISTRATION AREA

Back wash from the zeolite water softeners is held in plastic lined ponds for evaporation. Sewage is collected in clay lined lagoons for disposal by aerobic bacterial digestion and evaporation of most of the effluent with minimal amounts being released to grade.

III. RESEARCH AND DEVELOPMENT ACTIVITIES

The Research and Development effort at White Sands Test Facility consists of:

A. LIVE FIRINGS

1. Live firings of LM (Lunar Module) DPS (Descent Propulsion Systems), LTA-5R (Lunar Test Article), and Skylab Service Module RCS (Reaction Control System).
2. Live firings of Viking Mars Lander.

B. COMPATIBILITY AND MATERIALS TESTING

1. Compatibility tests for LM APS (Ascent Propulsion Systems) relief valves and PQGS (Propellant Quantity Gauging System) probes.

2. Nonmetallic materials tests consisting of flash and fire, gaseous oxygen impact, and reactivity to temperature and impact of materials immersed in fuel and oxidizer.

C. CLEANING AND CORROSION INVESTIGATION

1. Component cleaning for the Lunar Receiving Laboratory, MSC, Houston.
2. Alloy corrosion investigation.

IV. INSTITUTIONAL ENVIRONMENTAL CONSIDERATIONS

A. PLANNING AND CONSTRUCTION CONCEPTS

The present facility arrangements and locations were chosen because the meteorology of the area, due to the foothill terrain and irregular relief, is subject to rapid shifts in upslope wind flow directions. Protective construction is provided in the propulsion test areas. The test control centers are constructed to resist explosion pressure impulses, to attenuate rocket engine exhaust noise, and to provide a vapor-tight shelter for personnel. Although the construction includes piping with closed-loop transfer systems and venting systems which use burners or water ponds, the operating philosophy is to perform hazardous operations and release vapors only during daylight hours.

B. LAND USE

Present land utilization is confined primarily to three sections in the southwest corner of the 88 section site. The rugged site terrain to the east of the present facilities, and the possible exposure to toxic vapors from test operations, eliminates approximately twenty-three (23) sections from planned usage. Earlier master planning set aside eleven sections of the remaining area for a hydrogen-fluorine test complex; however, due to lack of information concerning future program planning, the remainder of WSTF has not been earmarked for any specific use and is available as may be required by future programs.

C. WASTE MANAGEMENT

Sewage from the test areas is handled by septic tanks and tile field systems. Other waste in the test areas, primarily water, is discharged through daylighted drain lines to the concrete-lined collection flumes and holding ponds due to the possible contamination of such waste with propellant. All liquids in holding ponds are neutralized prior to pumping to grade.

The sewage systems in the administrative and preparatory building areas consist of two-cell raw-sewage lagoons where algae growth provides supersaturated oxygen for aerobic bacterial decomposition of the sewage, and evaporation from the open water surface removes the effluent.

Scrap, garbage, and other solid wastes are picked up on a regular basis and disposed of through an onsite operated sanitary land fill.

D. EMISSIONS FROM HEATING FUELS

The heating fuel used at WSTF is natural gas supplied by the Rio Grande Natural Gas Company. The average hourly usage is approximately 6,000 cubic feet/hour, considerably below what is available. The combustion products of the gas-fired hot water boilers are vented directly to the atmosphere.

E. HERBICIDES AND INSECTICIDES

The White Sands Test Facility is cooperating with the Working Group on Pesticides (WGP) through NASA Headquarters, Division of Occupational Medicine and Environmental Health. As reported in WGP Form No. 1, "Pest Control Program Report" for calendar year 1971, the White Sands Test Facility uses 1/2 lb./acre of Malathion applied three times per year on approximately 8 acres for controlling scorpions, beetles, and spiders. In addition, Hyvar X (80 percent) is applied once a year to the same 8 acres at the rate of 1-1/4 lbs./acre for controlling weeds adjacent to the buildings. Both solutions are applied by compression sprayers.

V. ENVIRONMENTAL MONITORING AND CONTROL

A. ENVIRONMENTAL HEALTH PROGRAM

All employees on site are required to have physical examinations before starting to work and to have yearly followup examinations. A system of safety and industrial hygiene standards and instruction have been implemented which apply to the technical research and development operations of the site and regularly scheduled safety and industrial hygiene surveys and inspections of all laboratory and test site operations are made for the purpose of making recommendations to eliminate or control unsafe conditions and unsafe acts.

B. THE ENGINEERING OFFICE RESPONSIBILITIES

The engineering office maintains surveillance of site operations to assure that potential environmental quality problems are identified and resolved on a continuous and timely basis, and acts as coordinator with regulatory agencies.

C. POLLUTION CONTROL COORDINATOR

One person within the engineering office is assigned responsibility for environmental quality and control activities at White Sands Test Facility and serves as the White Sands Test Facility Pollution Control Coordinator of all such activities.

VI. ENVIRONMENTAL IMPACT

A. IMPACT OF WSTF ON THE LOWER NEW MEXICO AREA

The environmental impact of the NASA White Sands Test Facility on the lower New Mexico area has been minimal. Located on the western edge of the previously established White Sands Missile Range, the WSTF site was selected in 1962 with the consideration for its remoteness from urbanized areas. This location minimizes the possibility of nuisance and hazard from noise, odors, or other propellant-testing effects. A waste management and pollution control program has prevented environmental degradation from these sources. The wildlife population in the immediate area has flourished since the opening of WSTF. By continuing the use of strict meteorological and pollution controls, there is no reason to expect a detrimental effect in the future from planned operation of this installation.

B. POSSIBLE ADVERSE ENVIRONMENTAL EFFECTS

No adverse environmental effects from WSTF are foreseeable from the present and planned functions of the Test Facility, based on the geographical nature of the area and its consequent sparse population. The land utilized by the facility is of no substantial agricultural or recreational value. The noise, odor, or other nuisance factors common to testing facilities could be significantly detrimental only with a totally unexpected change in land use in this area.

C. ALTERNATIVES DUE TO ENVIRONMENTAL IMPACT

WSTF activities comply with the requirements of the Water Quality Standards summary dated February 1970 that have been jointly approved by the State of New Mexico and the Department of the Interior, Federal Water Pollution Control Administration. Neither onsite, nor offsite water supplies have been, or are expected to be affected.

There are no practical alternatives to the present and proposed testing activities. Moreover considering the advantages of remoteness from the general public, surface waters, and agriculture lands, there does not appear to be an alternate site for the type programs conducted at WSTF. Any unexpected and unpredictable requirement to restrict planned testing at WSTF would necessitate relocation of such functions.

D. RELATIONSHIP OF SHORT-TERM AND LONG-TERM EFFECTS

Short-term environmental effects of WSTF have been minimal. The area historically has had a sparsity of population, and no significant changes in human activities have resulted from the activities of this facility. Since 1962, some species of animals have increased in population in the area.

Similarly, there is no known impediment to the long-term productivity of the area because of the WSTF activities, or to the return of the WSTF site to the Department of Defense in accordance with the original land use agreement.

E. IRREVERSIBLE COMMITMENTS AND EFFECTS

There are no known significant irreversible commitments or effects from the WSTF activities. A positive pollution-control program, coordinated with regulatory agencies and monitored regularly, has revealed no institutional damage to the environment. The WSTF land and facilities can be returned to the Department of Defense in accordance with the land use agreement without any known environmental damage.

VII. COORDINATION WITH LOCAL, STATE AND FEDERAL AGENCIES

The various governmental agencies have been notified that WSTF has a Pollution Control Coordinator, and their cooperation in providing information on pollution control activities has been requested.

VIII. PUBLIC INFORMATION

All releases of information to the public is controlled through the Program Control Office at WSTF.

IX. SUMMARY

The selection of a portion of the White Sands Missile Range for the site of the NASA test facility provided an ideal environmental location for this installation. Based on the experience in operating the facility and testing hypergolic propellant engines since 1964, the environmental impact of WSTF has been negligible. A positive control program has been effective in protecting the environment from institutional pollution. Coordination in pollution control has been maintained with regulatory agencies. Neither the short-term or long-term effects of the WSTF have any known significant detriment to the environment.

By continuing the use of strict meteorological controls, there is no reason to expect results in the future to differ from experience in previous years.